SUMMARY

S.1 Introduction

The U.S. Atomic Energy Commission (AEC), a U.S. Department of Energy (DOE) predecessor agency, established the Savannah River Site (SRS) in the early 1950s for the production of nuclear materials to support the national defense, research, and medical programs of the United States. The Site continued that function until the early 1990s when the end of the Cold War led the United States to reduce the size of its nuclear arsenal.

This environmental impact statement (EIS) examines the environmental impacts of shutting down a 50-mile (80-kilometer) underground concrete piping structure and pumping system that was built in the early 1950s to provide cooling water for the Site's five nuclear production reactors. The reactors are no longer in operation and the Site's mission now emphasizes cleanup and environmental restoration.

S.2 Purpose and Need for Agency Action

The AEC built the River Water System during the 1950s to provide secondary cooling water from the Savannah River to the five production reactors (C-, K-, L-, P-, and R-Reactors) at the SRS. The system pumped water from the river to the reactor areas, where the water passed through heat exchangers to absorb heat from the reactor core. The heated discharge water returned to the river by way of several onsite streams. DOE constructed two lakes on the Site, Par Pond in 1958 to provide additional cooling water for P- and R-Reactors, and L-Lake in 1984 to dissipate the thermal effluents from L-Reactor. The stream channel of Lower Three Runs was expanded, a dam built across a section of its path, and the upstream area flooded to form Par Pond. Similarly, Steel Creek channel was expanded, an earthen dam built across its path, and the upstream area flooded to form L-Lake.

As a result of the end of the Cold War, the SRS mission emphasis has shifted from operation and production to cleanup and environmental restoration. Through the *DOE Savannah River Strategic Plan* and previous versions, DOE developed guidance for meeting the expanded missions. These strategic plans direct SRS organizations to identify excess infrastructure and to develop action plans for their disposition. As a result of this process, DOE identified the River Water System as excess infrastructure, costly to operate and maintain, and with limited application for new Site missions.

Therefore, in a climate of decreasing funding, DOE must determine if it should continue to operate the River Water System, a system that has no current mission and will become more expensive to operate.

S.3 Proposed Action

DOE proposes to shut down the River Water System and to place all or portions of the system in a standby condition that would enable restart if conditions or mission changes required system operation. DOE proposes to lay up all or portions of the system. Layup means that DOE would place equipment in a protective state that minimizes degradation. DOE would maintain those portions in a standby condition (could be readied for restart). DOE could also maintain portions of the system in a state of readiness higher than a standby condition in order to quickly restore pumping capability. The cessation of river water input to L-Lake is expected to result in a gradual drawdown of the reservoir and its reversion to the pre-L-Lake conditions of Steel Creek. During the expected drawdown period (about 10 years), DOE would apply

measures to ensure that it could refill L-Lake safely and would apply other measures to minimize potential adverse effects of exposed sediments, which contain contaminants, in the lakebed.

Examples of situations that could necessitate restarting the River Water System include the need to pump water into Par Pond to bring the lake back to a level greater than 195 feet (59 meters) above mean sea level. In an earlier National Environmental Policy Act (NEPA) action (DOE/EA-1070 and associated Finding of No Significant Impact, *Natural Fluctuation of Water Level in Par Pond and Reduced Water Flow in Steel Creek Below L-Lake at the Savannah River Site*, 1995), DOE decided to discharge a minimum flow of 10 cubic feet (0.23 cubic meter) per second to Lower Three Runs and to reduce pumping. The water level in Par Pond would fluctuate, but DOE would resume pumping if impact threshold levels were reached in water quantity or quality. Based on the extent of contamination and potential impacts to aquatic communities in the lakebed, 195 feet (59 meters) above mean sea level was established as a conservative lower limit to ensure minimal, if any, environmental impacts.

Other situations that could necessitate pumping include the need to refill L-Lake if the final outcome of the Federal Facility Agreement process recommends refilling the lake to an appropriate level, as a means of remediation. After the system is ready for restart, refilling would take approximately 4 months using two of the large river water system pumps. Following refill, a smaller pump would run continuously to maintain the lake level and downstream (Steel Creek) flow at a minimum of 10 cubic feet (0.28 cubic meter) per second.

New missions could also require restarting the River Water System. In the Record of Decision for the *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* (DOE/EIS-0161, 60 FR 63877), DOE selected SRS as the location for an accelerator, if one is built. Using the River Water System to supply cooling water to the accelerator could be a design option. DOE would identify the duration of the standby condition in the Record of Decision.

S.4 Alternatives

DOE is considering two alternatives to the Proposed Action. The first alternative, the No-Action Alternative, is defined as the continued operation of the River Water System with a 5,000-gallon-per-minute (0.32-cubic-meter-per-second) pump with large back-up pumps being maintained. DOE would maintain the large pumps in Pumphouse 3G in operational readiness. DOE would continue to use the system to provide the following:

- Fire protection at K- and L-Reactors
- Blending flow for the L-Area Sanitary Waste Treatment Plant effluent
- A full pool water level in L-Lake of 190 feet (58 meters) above mean sea level

In addition to these uses, DOE would retain the capability to pump river water to prevent the water level in Par Pond from falling below 195 feet (59 meters) above mean sea level and to ensure Steel Creek and Lower Three Runs received minimum discharges of 10 cubic feet (0.28 cubic meter) per second.

The second alternative would be to shut down and deactivate the River Water System. DOE would shut down the system in a secure, environmentally satisfactory condition. Under this alternative, DOE would have to implement alternatives for the requirements listed above except for the maintenance of the L-Lake water level. Cessation of river water flow to L-Lake would result in the gradual recession of the lake

to the original stream level of Steel Creek. Natural recharge to Steel Creek is expected to maintain an average flow of 10 cubic feet (0.28 cubic meter) per second. After drawdown, DOE would select an economical option for the earthen dam such as breaching or insuring unobstructed flow through the existing conduit. TC

Steel Creek is expected to maintain its natural flow, while Lower Three Runs would receive minimum discharges of 10 cubic feet (0.28 cubic meters) per second and Par Pond is expected to maintain a water level greater than 195 feet (60 meters). TC

S.5 Affected Environment

Located in southwest South Carolina, the SRS occupies an area of approximately 300 square miles (800 square kilometers). The Savannah River forms the Site's southwestern boundary for 27 miles (43 kilometers) on the South Carolina-Georgia border. The Site is approximately 25 miles (40 kilometers) southeast of Augusta, Georgia, and 20 miles (32 kilometers) south of Aiken, South Carolina, the nearest major population centers. TE

The SRS is on the Aiken Plateau, an area of broad flat surfaces dissected by narrow steep-sided valleys. Across the Site, elevations range from about 100 feet (30 meters) above sea level at the Savannah River to about 350 feet (107 meters) above sea level near the northern boundary. The climate is temperate with short mild winters and long humid summers. Warm, moist maritime air masses dominate the weather. TE

Open fields and pine and hardwood forests comprise 73 percent of the SRS; approximately 22 percent is wetlands, streams, or reservoirs (L-Lake and Par Pond). Production and support areas, roads, and utility corridors account for 5 percent of the total land area. L-Lake occupies about 1,000 acres (4 square kilometers) of the site and Par Pond about 2,640 acres (10.7 square kilometers). The Site is heavily forested with upland pine and mixed hardwoods. Since 1951, approximately 80,000 acres of former agricultural lands were planted with loblolly, longleaf, and slash pine to reduce erosion, provide forest products, and enhance wildlife habitat for white-tailed deer, wild turkey, and feral hogs, as well as the endangered red-cockaded woodpecker. TE TC TC

L-Lake averages 1,970 feet (600 meters) in width and extends along the Steel Creek Valley about 4.4 miles (7 kilometers) from the headwaters to the dam. Par Pond extends about 3.1 miles (5 kilometers) along the Lower Three Runs stream bed and has an average width of about 2,625 feet (800 meters). Both lakes have characteristic wetlands along the shoreline with pine and hardwood forests farther up the slope. The streams on the SRS generally flow in a southerly direction toward the Savannah River. Floodplains are characterized by bottomland hardwood forests or scrub-shrub wetlands with a variety of amphibian, reptile, wading bird, waterfowl, and terrestrial mammal populations. Water quality on the SRS is generally suitable for maintaining balanced biological communities.

Par Pond, a 2,640-acre (10.7-square-kilometer) reservoir, was created in 1958 by building an earthen dam (the Cold Dam) across the upper reaches of Lower Three Runs. It has an average depth of 20 feet (6.2 meters) and a maximum depth of 59 feet (18 meters). At normal pool, the reservoir storage volume is approximately 52,800 acre-feet (65 million cubic meters). TE

S.6 Environmental Consequences

This EIS evaluates alternative actions for the River Water System at the SRS. The alternatives cover the spectrum of reasonable actions from continued operation (No Action) to complete shutdown and deactivation (Shutdown and Deactivate) with no intention (and eventually no capability) to restart the system. The DOE Proposed Action and Preferred Alternative is a middle ground under which DOE would shut the system down, lay up all or portions of the system, and maintain some portions in a standby condition that would enable restart. The alternatives vary substantially in their ability to satisfy the purpose and need for DOE action, their costs to operate or maintain the system, their commitment of resources (primarily energy), and their environmental consequences. Table S-1 compares basic operational characteristics of the alternatives.

L12-05 Table S-2 summarizes and compares potential environmental impacts of the alternatives. The intent of this table is to draw from the detailed sections on affected environment and environmental impacts to present the primary impacts of the proposal and alternatives in comparative form. The following statements form the bases of the results reported in this table:

- TC DOE will operate a 5,000 gallon-per-minute (0.32 cubic-meter-per-second) pump as a way to save money and energy. In this EIS, flows and cost comparisons described under the No-Action Alternative reflect operation of the small pump.
- Under the shutdown alternatives, DOE would implement alternative sources for the river water required under No Action except that DOE would not provide water to L-Lake to maintain its water level. These requirements are reflected as an incremental impact of shutdown relative to No Action.
- Analyses indicate that L-Lake cannot maintain its normal pool level without flow augmentation from the River Water System. To ensure that impacts of the shutdown alternatives are not underestimated, DOE assumes a worst-case situation where L-Lake continues to recede until it reaches the original Steel Creek surface water profile.
- TE With the exception of capability under the Proposed Action to restart the River Water System to respond to potential future needs, impacts under the Shut Down and Deactivate Alternative are equal to those of the DOE Proposed Action and Preferred Alternative, Shut Down and Maintain.

Table S-1. Characteristics of the alternatives.

Data	No Action	Shut Down and Deactivate	Shut Down and Maintain	
	Small pump	No pumping	Jockey pump[a]	Dry layup[b]
Replacement/restart one-time cost[c]	NA[d]	NA	$820,000	$4,730,000
Time to restart	NA	NA	30 months	30 months
Cost of Operation		$200,000[e]		
System surveillance and maintenance	$1,084,000	$85,000[f]	$710,000	$85,000
L-Lake, Par Pond Dam surveillance and maintenance	520,000	$520,000[g]	520,000	520,000
Energy costs	494,000	20,000	71,000	44,000
Total annual cost	$2,098,000[h]	$625,000	$1,301,000	$649,000
Staff required[i]	7.8	1	6	1
Security (included in total costs)	Visual inspection 1/day	Visual inspection 1/day	Visual inspection 1/day	Visual inspection 1/day
Regulatory requirements	Intake canal dredging	None	Dredging[j] SCDHEC[k] permit for spoils	Dredging SCDHEC permit for spoils
Volume of water pumped	5,000-gallon-per-minute average	NA	Low flow to keep piping system pressurized	0

TC

a. The piping system would stay pressurized by operation of a very small pump called a jockey pump.
b. The piping system would be drained.
c. One-time cost to restart (high reliability).
d. NA = not applicable.
e. One-time cost to shut down.
f. One full-time equivalent person to handle minor maintenance.
g. This is an annual cost for L-Lake and Par Pond dams. After L-Lake has receded and the dam is breached, annual dam maintenance costs for L-Lake will be $0.
h. This cost does not include unexpected repair or replacement of the system.
i. Staff salary and overhead are included in system and dam maintenance cost.
j. Above costs do not include cost (if any) for re-permitting for dredging or reuse of existing spoil areas.
k. SCDHEC = South Carolina Department of Health and Environmental Control.

Table S-2. Comparison of the impacts of the alternatives for the River Water System.

Resource	No-Action Alternative	Shutdown Alternatives
Geology and Soils		
Castor Creek (tributary to Fourmile Branch) and headwaters of Steel Creek (upstream of L-Lake)	Minimal soil erosion from vegetated slopes and natural flows	Same as No-Action Alternative.
Indian Grave Branch (tributary to Pen Branch)	Minimal soil erosion from vegetated slopes carrying natural flows and river water and well water discharges from K-Area	Same as No-Action Alternative except well water would replace river water discharge.
Steel Creek and Lower Three Runs (below dams)	Minimal erosion and sedimentation rates due to controlled stream flow	Same as No-Action Alternative for Lower Three Runs and Steel Creek while L-Lake drains, after which Steel Creek flows would be variable and uncontrolled and would experience moderate erosion and sedimentation from lakebed.
L-Lake and Par Pond	Minimal erosion due to constant normal pool water elevations in L-Lake and small fluctuations in Par Pond	Minimal remobilization of soils potentially contaminated by preimpoundment activities due to gradual recession of L-Lake; same as No-Action Alternative in Par Pond.
Surface Water		
Par Pond	Par Pond ecosystem would revert to that typically found in reservoirs in Southeast due to reduction of nutrients from Savannah River; DOE could resume pumping to Par Pond if conditions warranted	Reversion to typical southeastern reservoir, as with No-Action Alternative; under Shut Down and Maintain, DOE could prepare system for operation, then restart system to pump to Par Pond; no capability to pump under Shut Down and Deactivate.
L-Lake	Water level sustained by as much as 4,800 gpm[a] of river water pumped to and discharged from L-Area	Reversion to stream conditions with potential for lakebed erosion.
L-Lake water quality	Dissolved oxygen in epilimnion seldom would fall below 5 milligrams per liter and would generally be greater than 1 milligram per liter in hypolimnion. Lowest temperatures would be around 50°F (10°C); maximum near-surface summer temperatures would be around 86°F (30°C); acidity would not be substantial; pH levels in near-surface water would seldom fall below 6.	Reduction in dissolved oxygen and temperature and increased acidity in epilimnion and hypolimnion of L-Lake until lake is drained.
TC Steel Creek	Minimal siltation due to intake structure drawing water that would be low in suspended solids from top of lake; flow of 10 cfs[b] would be sustained	The dam is expected to act as a sedimentation basin, thereby minimizing siltation below dam.
L-Area sanitary wastewater treatment plant	Blending flows would be supplied by river water pumping to L-Area	Alternate compliance method (e.g., septic tanks) would be required.

Table S-2. (continued).

Resource	No-Action Alternative	Shutdown Alternatives
L-Area cooling water discharges	L-Area 186-Basin maintained full for fire protection and overflowing for discharges to L-Lake; well water or river water could supply 190 gpm of cooling water for compressors	Alternate supply (e.g., well water) would be required for fire protection and compressor cooling; total well water requirement would be 390 gpm; total discharge to L-Lake would be reduced by 10 gpm evaporation from the 186-Basin to approximately 380 gpm.
K-Area cooling water discharges	As much as 200 gpm pumped from system to K-Area 186-Basin for fire protection; well water would supply 210 gpm of cooling water for compressors	Alternate supply (e.g., well water) would be required for fire protection; same as No-Action Alternative for compressor cooling water; total discharge to Indian Grave Branch would be approximately 400 gpm (i.e., 200+210 less evaporation).
Groundwater		
Water table levels in L-Area	With downgradient elevation of Water Table Aquifer controlled by lake level, it would stand at 190 ft[c] above mean sea level; Water Table Aquifer elevation at L-Area Oil and Chemical Basin (one of four nearby CERCLA[d] units) would be approximately 208 ft	As L-Lake recedes, water table elevations would drop 10 ft at Steel Creek outcrop (estimated 180 ft); at L-Area Oil and Chemical Basin, water table elevations would drop approximately 4 ft (estimated 204 ft); hydraulic gradients at CERCLA units would increase resulting in a 12-percent increase in local velocities. After lake level dropped, it would take approximately 18 years for contaminated groundwater to travel from CERCLA units to Steel Creek. Therefore, there would be little, if any, effect on remedial actions for these units.
Air		
Air toxic - Mercury	0.014 microgram per cubic meter	Increased by 1.15×10^{-6} microgram per cubic meter to approximately 6 percent of regulatory standard.
Air toxic - Manganese	0.821 microgram per cubic meter	Increased by 2.6×10^{-6} microgram per cubic meter to approximately 3 percent of regulatory standard. TC
Criteria pollutant - 24-hour PM_{10} concentration at SRS boundary	SRS sources plus background = 113 micrograms per cubic meter at the SRS boundary	Increase of 16 for a total of 129 micrograms per cubic meter at the SRS boundary, which is 85.7 percent of regulatory standard.
Radionuclides - annual effective inhalation dose equivalent to maximally exposed offsite individual	Very small dose (0.02 millirem/yr)	Total dose from all pathways 6.5×10^{-3} (mrem/yr); 0.07 percent of regulatory standard. TC

Table S-2. (continued).

Resource	No-Action Alternative	Shutdown Alternatives
Terrestrial Ecology		
TE L-Lake	No reduction in habitat for amphibians, reptiles, semiaquatic mammals, wading birds, and waterfowl in L-Lake	Reduction in habitat for amphibians, reptiles, semiaquatic mammals, wading birds, and waterfowl as L-Lake recedes.
	L-Lake amphibians, reptiles, semiaquatic mammals, wading birds, and waterfowl would be protected from predation	L-Lake amphibians, reptiles, semiaquatic mammals, wading birds, and waterfowl would be more vulnerable to predation as reservoir recedes.
	No increased exposure to contaminated L-Lake sediments	Animals foraging in the lakebed after drawdown would be exposed to contaminated sediments via inhalation, ingestion, and dermal contact.
Aquatic Ecology		
L-Lake	Natural changes in aquatic communities as L-Lake ages	Reservoir ecosystem replaced by small stream ecosystem.
SRS streams	Natural flows in small watersheds support few benthic organisms and fish in Indian Grave Branch	Same as No-Action Alternative.
Wetlands		
L-Lake	Natural successional changes in littoral zone plant communities	Loss of submerged and floating-leaved aquatic plants as reservoir recedes; emergent species could move downslope with lake level.
Par Pond	Changes in species composition of littoral-zone plants; acreage could be reduced	Same as No-Action Alternative.
TC Steel Creek	With 10 cfs flow requirement, scrub-shrub vegetation would become more prevalent in stream corridor; willow probably would predominate. Over time, hardwood species would become established in delta, replacing swamp (cypress-gum) forest with deciduous hardwood (oak-elm-sweetgum) forest.	Same as No-Action Alternative during drawdown; after drawdown, natural flows would vary, averaging 10 cfs.
Lower Three Runs	Readjustment of stream and bottomland ecosystems associated with continuation of existing flow requirements	Same as No-Action Alternative.
Threatened and Endangered Species		
Bald eagles	Bald eagles nesting at Pen Branch would continue to forage around L-Lake	Bald eagles nesting at Pen Branch would in time lose primary foraging habitat (L-Lake) and could leave area.

Table S-2. (continued).

Resource	No-Action Alternative	Shutdown Alternatives	
Wood storks	Foraging on SRS would continue	Wood storks could be exposed to increased levels of contaminants if L-Lake dropped rapidly and fish were trapped in small pools (primarily in spring and summer, when wood storks forage on SRS).	TC
Alligators	Alligators would continue to be present in L-Lake	L-Lake alligators would, in time, be displaced; drawdown of L-Lake could result in loss of nests, eggs, or hatchlings, depending on timing and rapidity of drawdown.	
Occupational Health			
Radiological - annual probability of fatal cancer to current involved worker (annual fatal cancer risk from all causes is 3.4×10^{-3})[e]	1.7×10^{-7}	1.7×10^{-7}	TC
Radiological - number of lifetime fatal cancers to current SRS involved workers (16 lifetime fatal cancers from all causes expected in current SRS involved worker population)[e]	5.5×10^{-5}	5.5×10^{-5}	TE
Nonradiological - annual probability of fatal cancer to current SRS involved worker (annual fatal cancer risk from all causes is 3.4×10^{-3})[e]	2.5×10^{-8}	1.4×10^{-6}	TC
Public Health			
Radiological - annual probability of fatal cancer to offsite maximally exposed individual (annual fatal cancer risk from all causes is 3.4×10^{-3})[e]	3.3×10^{-9}	3.5×10^{-9}	TC
Radiological - number of lifetime fatal cancers to offsite population (157,900 lifetime fatal cancers from all causes expected in the offsite population living within 50 miles of SRS)[e]	5.0×10^{-5}	4.9×10^{-5}	TC
Nonradiological - annual probability of fatal cancer to offsite maximally exposed individual (annual fatal risk from all causes is 3.4×10^{-3})[e]	None	7.9×10^{-9}	TC

Table S-2. (continued).

Resource	No-Action Alternative	Shutdown Alternatives
Land Use		
Onsite	Site facilities, natural vegetation types with more than 73 percent in forest land	Same as No-Action Alternative
Adjacent land	Used mainly for forest, agricultural, and industrial purposes	Same as No-Action Alternative
Aesthetics		
TE L12-09 L-Lake	1,000-acre reservoir with wetlands along shoreline and abundance of wading birds, turtles, and some alligators	As L-Lake recedes, dried mud flats would appear for periods of time until revegetation began; could be seen by 1,800 SRS workers who pass by daily.
Par Pond	2,640-acre reservoir with wetlands along shoreline, pine and hardwood forests up slope; abundance of amphibians, reptiles, wading birds, and waterfowl (in winter); water level fluctuates while discharge from Par Pond is controlled.	Same as No-Action Alternative
SRS streams	Narrow streams at headwaters broadening into wide swampy deltas at Savannah River; abundant hardwood and wetland vegetation with variety of wildlife; 10 cfs in Lower Three Runs and Steel Creek downstream of dams; natural flow in Fourmile Branch and Steel Creek above L-Lake; natural flow plus small cooling water discharges to Indian Grave Branch/Pen Branch	Same as No-Action Alternative

a. gpm = gallons per minute; to convert to cubic meters per second, multiply by 0.000063088.
b. cfs = cubic feet per second; to convert to cubic meters per second, multiply by 0.028317.
c. ft = feet; to convert to meters, multiply by 0.3048.
TE d. CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act.
e. Based on fatal cancer incidence in general population of 235 per 1,000 and a 70-year life expectancy.